

Rationale for Development of Work-Related Asthma Educational Tools for Asthmatics

Susan M. Tarlo, MB, BS^{1,2,3,4,5,*}

Gary M. Liss, MD⁵

Joshua C. Lipszyc, MSc^{2,3}

Samir Gupta, MD^{2,4}

Address

*¹Toronto Western Hospital, University of Toronto, EW7-449, 39 Bathurst St, Toronto, ON, M5T 2S8, Canada
Email: susan.tarlo@utoronto.ca

²St Michael's Hospital, University of Toronto, Toronto, ON, Canada

³Institute of Medical Sciences, University of Toronto, Toronto, ON, Canada

⁴Department of Medicine, University of Toronto, Toronto, ON, Canada

⁵Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada

Published online: 3 May 2017

© Springer International Publishing AG 2017

This article is part of the Topical Collection on *Occupational Allergy*

Keywords Asthma · Work-related asthma · Young adults · Education · Web-based

Opinion statement

Currently, young asthmatics have little knowledge of the potential effects of work exposures on their asthma. We expect that education of young asthmatics about the potential effects of the working environment on their asthma and appropriate steps to reduce work-related exacerbations will provide these individuals with skills to better control their asthma. Currently, there is no formal process for this education to our knowledge. Since the Internet is readily available and widely used by most young asthmatics, it may provide a useful forum for such education. Our preliminary studies with development and early validation of a Web-based educational tool for work-related asthma suggest that this can provide education and may prove to be a useful resource. Additional studies are needed to determine whether this can be easily used in high schools or trade schools or in the workplace, and whether the knowledge gained can translate into reduction of morbidity. Potentially, benefit may also accrue to older working adults with asthma or those at increased risk of developing occupational asthma.

Introduction

Asthma is a common chronic condition among adolescents and young adults in the developed world. In North America, asthma has been demonstrated to affect 9–12% [1] of young adults and 5–7% of adults [2]. In a Canadian asthma clinic study, about 40% of 731 adult asthmatics showed onset of symptoms in childhood [3]. From an administrative database in Ontario, Canada, it has been estimated that although asthma incidence rates are falling, the prevalence of asthma will continue to rise, to an estimated one in eight individuals in Ontario by 2022 [4]. Adolescent asthmatics often continue to experience asthma symptoms throughout adulthood [5], and exacerbations and poor control of asthma may lead to limitations in quality of life and decline in health status, as well as negative occupational and socioeconomic consequences [6].

For workers with asthma, exposure to workplace irritants and sensitizers can result in work-related exacerbations. Work-related asthma (WRA) is a general term which comprises occupational asthma (OA—new-onset asthma caused by work) and work-exacerbated asthma (WEA—existing asthma worsened by a workplace trigger). Most research has focused on OA and prevention of this through primary, secondary, and tertiary preventive measures. There has been some evidence for success

with this approach, as previously reviewed [7]. However, worldwide, WRA frequency has been increasing over the past two decades [8, 9]. Accordingly, the contribution of WEA to WRA morbidity has been increasingly recognized. WRA accounted for about 50% of all accepted WRA claims in Ontario [10] in the early 1990s, but accounted for over 70% more recently [11]. WRA has been estimated to occur in up to 25% of asthmatic workers and studies have indicated that the socioeconomic impact of WEA can be great and similar to that of OA [12]. Accordingly, the 2008 Consensus Statement of the American College of Chest Physicians on WRA diagnosis, management, and prevention has included a focus on WEA, with advice to reduce exposures to potential asthma exacerbating triggers, optimize general asthma control, and improve worker education [13]. A report from the European Respiratory Community Health Survey II [14] indicated that uncontrolled adult-onset asthma, starting at age 16 or older, was often associated with exposure to “asthmagens” at work (that described agents identified as being disease related, including high- and low-molecular weight sensitizing agents and irritant agents). The authors advised that occupational risk factors be identified early to prevent exacerbations.

Rationale for Development of Work-Related Asthma Educational Tools for Asthmatics

A report from British Columbia indicated 10-year cumulative prevalence rates of asthma among members of the working-age population of 51 and 68 cases per 1000 among male and female workers, respectively [15]. The corresponding prevalence of asthma in the preworking age population (ages 10 to 14) was 154 and 108 cases per 1000 among male and female adolescents, respectively. This high prevalence of asthma among adolescents highlights previous literature showing that adolescents can enter the workforce with preexisting sensitivities that may predispose them to exacerbations and to increased risk of occupational allergy and asthma [16, 17]. Among workers with WEA in Ontario, a lack of worker knowledge regarding the impact of work on asthma and of agents that could affect asthma at work was reported as barriers to early diagnosis [18, 19•].

Exacerbation of asthma related to work can occur from many triggers, including several that would not affect workers who did not have asthma and exposures that would not be generally considered “hazardous.” These include exposures that may cause an irritant-related exacerbation of asthma, and also exposures that can cause sensitization and occupational asthma.

Since many young asthmatics are atopic, they may have a greater risk of developing sensitization to high-molecular weight allergens that relatively commonly cause OA such as wheat, animals, and fungi [17]. Many such asthma triggers are not likely to be included in information provided to workers regarding dangers to health from the materials to which they have exposure at work (e.g., in the USA, disclosures required by the US Occupational Safety and Health Act of 1970 and the Workers' Right to Know law [20•], and in Canada, the Occupational Health and Safety Legislation [21]). Therefore, educational measures to improve worker knowledge of possible asthma-causing and exacerbating agents at work may often not be adequately provided through the workplace. As a result, initiating employment in a work environment with asthma triggers may handicap the occupational success and economic viability of a patient with asthma. Additionally, sub-optimal awareness of occupational risks among adolescents with asthma entering the workforce may lead to cases of WEA and OA that could have been prevented. As a population group, adolescent asthmatics present obstacles to optimal asthma care in terms of exposure and trigger control as well as medication compliance [22, 23]. Asthma during adolescence can continue into the adult years, and appreciation of the potential consequences associated with career choice and understanding of workplace triggers among adolescent asthmatics has also increased in recent years [17].

Education regarding possible triggers at work could be delivered by a primary health care provider or asthma specialist. However, despite the high prevalence of WEA, occupational histories taken by health care providers from asthmatics (even in academic settings) have been shown to be incomplete and discordant with histories documented by patients [24]. A Canadian study survey of family doctors and respiratory specialist physicians reported that a majority indicated a need for further education regarding occupational lung diseases [25].

Asthma educators can provide excellent information to patients with asthma regarding triggers, avoidance measures for relevant triggers, appropriate use of inhalers, and management of exacerbations [26]. However, there is limited availability of asthma educators in primary health care. Educational booklets and pamphlets have been developed by Lung Associations and Occupational Health Clinics to assist asthma educators in identifying and providing information on workplace triggers and to provide workers with more information, but their impact on knowledge or behavior has not been objectively measured, to our knowledge.

Ideally, adolescents and young adults with asthma would receive information about WRA before entering the workforce. To the best of our knowledge, no program has existed to systematically provide such information. The Internet is an attractive choice as an educational medium in this population. An interactive, online tool would allow dynamic and flexible content presentation that can be rapidly modified to reflect new data and/or changing demands, easy accessibility from any Internet-accessible computer or handheld device, and increased privacy of content delivery, as access need not occur in a physician's office, school classroom, or guidance office. Additionally, Internet-based knowledge transfer results in the possibility of self-initiated, convenient data access, available 24 h a day. These features address many of the health system barriers to conventional asthma education,

including limited availability of staff time, the need for educational approaches that can be sustained across various settings of care (school, home, clinic), the need to adjust content to meet individual patients' needs, a desire to monitor learners' comprehension, conservation of patients' time and resources, and lack of reimbursement for patient education [27].

Approximately, 89% of North Americans now have access to the Internet (<http://www.internetworldstats.com/stats.htm>), and over 72% of Internet users reported searching online for health information within the past year [28]. The Internet may be particularly effective in adolescents and young adults because they often have both easy access and the technical ability required and because they often perceive computers to be an attractive leisure activity [29]. Previous studies have demonstrated that unmet adolescent health needs can be very successfully addressed in a Web-based environment [30]. Qualitative studies have also demonstrated the willingness of asthmatics [31], and of adolescent asthmatics in particular, to use Web-based resources for asthma education [32]. A previous study of a Web-based asthma information resource demonstrated not only high levels of patient acceptance and improved asthma knowledge, but also improved asthma-related health outcomes in children and adolescents with asthma [33]. A randomized controlled trial of an interactive multimedia asthma education and tracking system in asthmatics between ages 7–17 demonstrated similar results, with most participants finding it easy to use and expressing a willingness to use it again [27]. In a previous study, an asthma website designed to provide patients with personalized feedback regarding their condition prior to a physician visit enhanced their knowledge of asthma and improved communication with their physician. Physicians suggested that the website has the potential to improve the quality of care provided to patients with asthma [34].

Another unique feature of an Internet-based educational resource is the ability to promote user engagement through peer interactivity, by enabling such features as chat rooms, web logs, e-mail, and message boards. A qualitative study suggested that adolescents with asthma value peer information sharing as part of learning [32], and programs incorporating a social function are generally more popular with young people, often supporting friendships and providing peer supports for those who may otherwise feel isolated due to their health condition [29, 35]. This feature would be valuable in a Web-based WEA educational resource, enabling open communication and learning between peers about particular asthma-related workplace dangers and protection.

Improved awareness of risk factors and preventive strategies among adolescents and young adults entering the workforce may reduce morbidity, work loss, and socioeconomic consequences in this large group of workers. While there is no place for preemployment screening, and those with asthma should not suffer discrimination in their choice of jobs due to their asthma, we nevertheless consider it appropriate for those with asthma who are planning work, and for those who have recently started work, to understand whether or not there is an increased chance of asthma exacerbation from the job they select and how to detect and manage exacerbations that may occur (in some cases by adjustment of asthma medications alone, and in other cases, by also modifying the work exposure(s)).

Considering the potential impact of WEA on occupational and socioeconomic status, our research group sought to identify the degree to which adolescent asthmatics perceive and appreciate asthma as a factor in career choice. Our findings [36] showed that 65% of adolescents and young adults with asthma state that asthma is not an important factor in their career plans and that only 54% believe that it is important to wear protective equipment in the workplace when appropriate. Additionally, 44% of participants could not identify any occupation that could potentially aggravate asthma. While 80% of these asthmatics sought out their family physician for asthma care, they were statistically more likely to discuss asthma and its impact on their future career with their parents or friends than with their physician. While optimal medical management of young adult asthmatics can be achieved if physicians understand their needs and perspectives towards their asthma, the findings of our research group indicate that clear knowledge gaps exist among young adult asthmatics with respect to the interaction between asthma and the workplace, and these issues are not routinely raised with primary care physicians. This further reinforces the need for a patient-directed educational intervention.

To date, the impact of WEA education on behavioral and clinical outcomes in adolescents and young adults with asthma has not been evaluated. Factors which are likely to enable adolescents and young adults to make informed decisions about potential workplace hazards and risk mitigation strategies include the following: (a) knowledge of potential asthma triggers that can be found in various workplaces (industrial and non-industrial), including potential irritants and potential allergens and the difference between these; (b) understanding the influence of underlying asthma severity and asthma control on work exacerbation; (c) understanding how to determine personal asthma severity and current level of asthma control; and (d) immediate and long-term actions to take if asthma worsens while employed, and particularly while at work [37].

It should be noted that knowledge and care gaps relating to WEA are not limited to patients, but extend into primary care as well. Primary health care providers often have inadequate training and knowledge of WEA and have limited time to explore these issues with patients. Accordingly, a patient-oriented Web-based work-related asthma educational tool may fill this need. After a market survey indicated a lack of adequate existing Web-based WRA resources, our research team developed such a resource through iterative design and testing in serial focus groups with young asthmatics [37]. Recently, we also demonstrated that this tool successfully increases WRA knowledge in patients seen at a tertiary care asthma clinic [38••]. This pilot study involved 34 adult asthmatics, 23 (68%) of whom were employed at the time of their clinic visit. The average age was 51 years (range 22 to 83 years), a majority were female (68%), and the mean time since asthma diagnosis was 22 years. Participants scored significantly higher on a WRA knowledge questionnaire following interaction with the Web-based tool, and most knowledge gains were retained at 1-year follow-up (19 participants). Further validation of this tool and any other such educational tools among young asthmatics, including their impact on asthma-related and workplace behaviors, and ultimately, on clinical outcomes, is now required.

Compliance with Ethical Standards

Conflict of Interest

Dr. Susan Tarlo and Dr. Gary Liss have previously received peer-reviewed research grant funding from the Ontario Workplace Safety and Insurance Board, and Drs. Susan Tarlo, Gary Liss, and Samir Gupta have received funding from WorkSafe BC and the Workers' Compensation Board of Newfoundland and Labrador to develop a Web-based educational program on work-related asthma.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

References and Recommended Reading

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Habbick BF, Pizzichini MM, Taylor B, Rennie D, Senthilselvan A, Sears MR. Prevalence of asthma, rhinitis and eczema among children in 2 Canadian cities: the International Study of Asthma and Allergies in Childhood. *CMAJ*. 1999;160(13):1824–8.
2. Manfreda J, Becklake MR, Sears MR, Chan-Yeung M, Dimich-Ward H, Siersted HC, et al. Prevalence of asthma symptoms among adults aged 20–44 years in Canada. *CMAJ*. 2001;164(7):995–1001.
3. Tarlo SM, Leung K, Broder I, Silverman F, Holness DL. Asthmatic subjects symptomatically worse at work: prevalence and characterization among a general asthma clinic population. *Chest*. 2000;118(5):1309–14.
4. To T, Stanojevic S, Feldman R, Moineddin R, Atenafu EG, Guan J, et al. Is asthma a vanishing disease? A study to forecast the burden of asthma in 2022. *BMC Public Health*. 2013;13:254.
5. Gautrin D, Ghezzi H, Infante-Rivard C, Malo JL. Incidence and determinants of IgE-mediated sensitization in apprentices. A prospective study. *Am J Respir Crit Care Med*. 2000;162(4 Pt 1):1222–8.
6. Schmier JK, Manjunath R, Halpern MT, Jones ML, Thompson K, Diette GB. The impact of inadequately controlled asthma in urban children on quality of life and productivity. *Ann Allergy Asthma Immunol*. 2007;98(3):245–51.
7. Tarlo SM, Liss GM. Prevention of occupational asthma—practical implications for occupational physicians. *Occup Med (Lond)*. 2005;55(8):588–94.
8. Hendrick DJ. The world wide problem of occupational asthma. *Clin Exp Allergy*. 2001;31(1):1–4.
9. Henneberger PK. Work-exacerbated asthma. *Curr Opin Allergy Clin Immunol*. 2007;7(2):146–51.
10. Tarlo SM, Liss G, Corey P, Broder I. A workers' compensation claim population for occupational asthma. Comparison of subgroups. *Chest*. 1995;107(3):634–41.
11. Lim T, Liss GM, Vernich L, Buyantseva L, Tarlo SM. Work-exacerbated asthma in a workers' compensation population. *Occup Med (Lond)*. 2014;64(3):206–10.
12. Vandenplas O, Henneberger PK. Socioeconomic outcomes in work-exacerbated asthma. *Curr Opin Allergy Clin Immunol*. 2007;7(3):236–41.
13. Tarlo SM, Balmes J, Balkissoon R, Beach J, Beckett W, Bernstein D, et al. Diagnosis and management of work-related asthma: American College Of Chest Physicians Consensus Statement. *Chest*. 2008;134(3 Suppl):1S–41S.
14. Le Moual N, Carsin AE, Siroux V, Radon K, Norback D, Toren K, et al. Occupational exposures and uncontrolled adult-onset asthma in the European Community Respiratory Health Survey II. *Eur Respir J*. 2014;43(2):374–86.
15. Asthma in British Columbia: determining how much asthma is work related. UBC Centre for Health Services and Policy Research, Research Briefs. 2007.
16. Cullinan P, Tarlo S, Nemery B. The prevention of occupational asthma. *Eur Respir J*. 2003;22(5):853–60.
17. Moscato G, Pala G, Boillat MA, Folletti I, Gerth van Wijk R, Olgiati-Des Gouttes D, et al. EAACI position paper: prevention of work-related respiratory allergies among pre-apprentices or apprentices and young workers. *Allergy*. 2011;66(9):1164–73.
18. Santos MS, Jung H, Peyrovi J, Lou W, Liss GM, Tarlo SM. Occupational asthma and work-exacerbated asthma: factors associated with time to diagnostic steps. *Chest*. 2007;131(6):1768–75.
- 19.• Walters GI, Soundy A, Robertson AS, Burge PS, Ayres JG. Understanding health beliefs and behaviour in workers with suspected occupational asthma. *Respir Med*. 2015;109(3):379–88.

A semi-structured interview was used in 20 patients with work-related asthma to identify reasons for delays in diagnosis and health beliefs. The four themes identified were as follows:

worker knowledge relating to symptoms, work relationships, the workers' course of action, and relationships with health professionals.

- 20.● Rosner D, Markowitz G. "Educate the individual... To a sane appreciation of the risk" a history of industry's responsibility to warn of job dangers before the Occupational Safety and Health Administration. *Am J Public Health*. 2016;106(1):28–35.

This article describes the background to the development of the Occupational Safety and Health Act of 1970 and the Workers' Right to Know laws in North America.

21. Safety CCfOHa. Government of Canada; Available from: <http://www.ccohs.ca/>.
22. Cochrane GM. Therapeutic compliance in asthma; its magnitude and implications. *Eur Respir J*. 1992;5(1):122–4.
23. Dinwiddie R, Muller WG. Adolescent treatment compliance in asthma. *J R Soc Med*. 2002;95(2):68–71.
24. Shofer S, Haus BM, Kuschner WG. Quality of occupational history assessments in working age adults with newly diagnosed asthma. *Chest*. 2006;130(2):455–62.
25. Holness DL, Tabassum S, Tarlo SM, Liss GM, Silverman F, Manno M. Practice patterns of pulmonologists and family physicians for occupational asthma. *Chest*. 2007;132(5):1526–31.
26. Cicutto L, Burns P, Brown N. A training program for certified asthma educators: assessing performance. *J Asthma*. 2005;42(7):561–5.
27. Krishna S, Francisco BD, Balas EA, Konig P, Graff GR, Madsen RW, et al. Internet-enabled interactive multimedia asthma education program: a randomized trial. *Pediatrics*. 2003;111(3):503–10.
28. Health Fact Sheet: Pew Research Center Internet Science and Technology; 2013 [updated 16th December 2013. Available from: <http://www.pewinternet.org/fact-sheets/health-fact-sheet/>.
29. McPherson AC, Glazebrook C, Smyth AR. Educational interventions—computers for delivering education to children with respiratory illness and to their parents. *Paediatr Respir Rev*. 2005;6(3):215–26.
30. McPherson A, Macfarlane A. Health information for young people where and when they most want it: a

case study of www.teenagehealthfreak.org. *Adolesc Med State Art Rev*. 2007;18(2):407–14. xiv

31. Fonseca JA, Costa-Pereira A, Delgado L, Fernandes L, Castel-Branco MG. Asthma patients are willing to use mobile and Web technologies to support self-management. *Allergy*. 2006;61(3):389–90.
32. Rhee H, Wyatt TH, Wenzel JA. Adolescents with asthma: learning needs and internet use assessment. *Respir Care*. 2006;51(12):1441–9.
33. Runge C, Lecheler J, Horn M, Tews JT, Schaefer M. Outcomes of a Web-based patient education program for asthmatic children and adolescents. *Chest*. 2006;129(3):581–93.
34. Hartmann CW, Sciamanna CN, Blanch DC, Mui S, Lawless H, Manocchia M, et al. A website to improve asthma care by suggesting patient questions for physicians: qualitative analysis of user experiences. *J Med Internet Res*. 2007;9(1):e3.
35. Cabana MD, Le TT. Challenges in asthma patient education. *J Allergy Clin Immunol*. 2005;115(6):1225–7.
36. Bhinder S, Cicutto L, Abdel-Qadir HM, Tarlo SM. Perception of asthma as a factor in career choice among young adults with asthma. *Can Respir J*. 2009;16(6):e69–75.
37. Ghajar-Khosravi S, Tarlo SM, Liss GM, Chignell M, Ribeiro M, Levinson AJ, et al. Development of a Web-based, work-related asthma educational tool for patients with asthma. *Can Respir J*. 2013;20(6):417–23.
- 38.● Lipszyc JC, Gotzev S, Scarborough J, Liss GM, Gupta S, Tarlo SM. Evaluation of the efficacy of a Web-based work-related asthma educational tool. *J Asthma*. 2016;53(10):1071–5.

This was an initial evaluation of a Web-based educational tool for work-related asthma. It used a convenience sample of asthmatic patients from a tertiary clinic to assess baseline knowledge of work-related asthma and then re-evaluate knowledge after a short use of the educational tool. This showed a significant improvement in knowledge and the improvement was also maintained 1 year later. The study may have underestimated improvements that could occur in asthmatics from primary care since participants in this study had previous access to an asthma educator in the clinic.